TRANSISTOR P.A. AMPLIFIER

Model 3000 6000

INSTRUCTION MANUAL

B & K MANUFACTURING COMPANY

DIVISION OF DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVENUE, CHICAGO 13, ILLINOIS

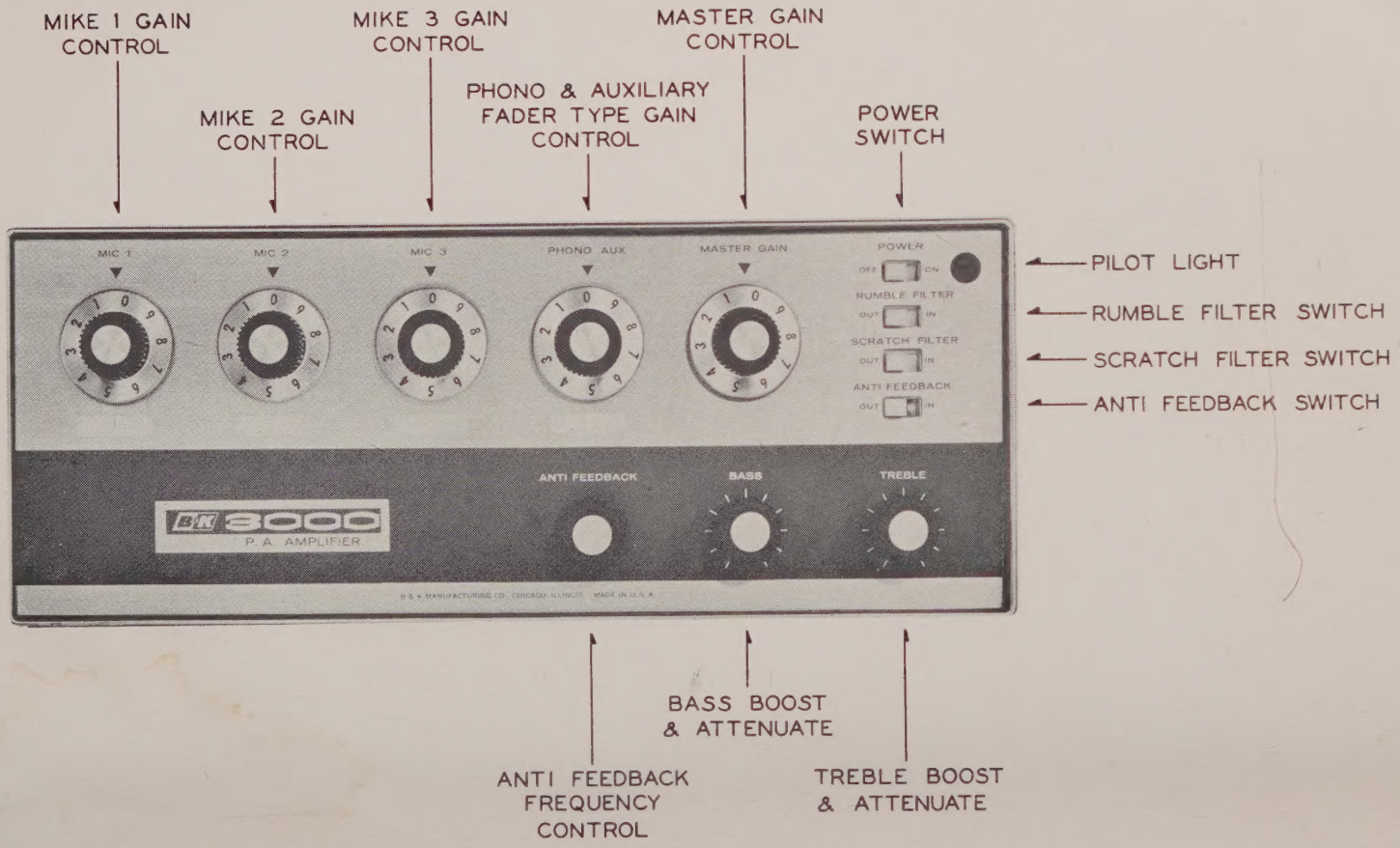

Fig. 1—Front Panel.

INSTRUCTION MANUAL

FOR

Model 3000 6000

Transistor

P.A. Amplifier

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1801 West Belle Plaine Avenue
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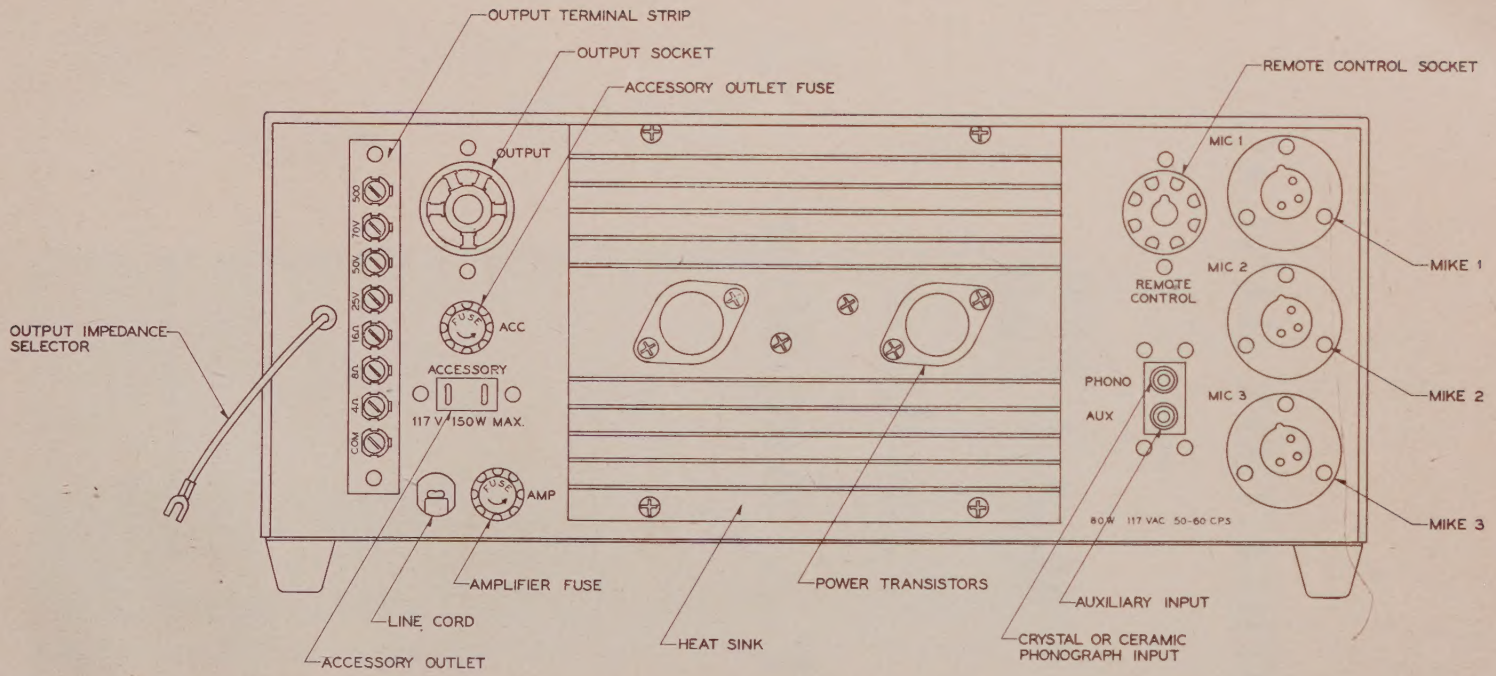


Fig. 2—Rear Panel.

CAUTION

It is extremely important to provide proper ventilation for the transistor heat sink which projects from the rear of the amplifier. If the amplifier is mounted on a shelf, be sure there is circulation at the rear. Always provide a circulating air space behind the amplifier around the heat sink. The amplifier should always be operated with the mounting feet on which allows air to flow thru the perforated metal bottom plate and out the vents on the top cover. Do not place any obstruction on top of the amplifier, thus preventing air circulation thru the cover vents.

SPECIFICATIONS

	MODEL 3000	MODEL 6000
Power Output:	30 Watts RMS Power	60 Watts RMS Power
Frequency Response:	20 to 20,000 CPS ± 2 D.B.	
Gain, Microphone:	5 M.V. for 30 Watts	5 M.V. for 60 Watts
Gain, Phono-Aux:	1 V RMS for 30 Watts	1 V RMS for 60 Watts
Output Impedances:	4 Ohms 8 Ohms 16 Ohms 25 Volts 50 Volts 70.7 Volts 500 Ohms	
Controls:	Microphone Channel #1; Microphone Gain Microphone Channel #2; Microphone Gain Microphone Channel #3; Microphone Gain Phono-Aux Gain Master Gain Anti-Feedback On-Off Anti-Feedback Scratch Filter On-Off Rumble Filter On-Off Power On-Off	
Semiconductors:	11 high fidelity audio type plus 4 diodes	
Power Source:	117V 60 CPS; 1.0 Amps Model 3000; 2.0 Amps Model 6000	
Convenience Outlet:	150 Watts maximum, separately fused.	

GENERAL

The Models 3000 and 6000 high fidelity transistorized public address amplifiers incorporate the latest solid state design techniques. These amplifiers provide the utmost in user convenience and operating ease.

The three microphone inputs can accommodate high impedance crystal and ceramic microphones, or low impedance dynamic microphones. Low impedance input matching transformers can be plugged directly into the amplifier chassis. Microphone gain can be remotely controlled by simply plugging in a remote gain control accessory unit into the remote control socket on the amplifier rear.

A Fader type Phono-Aux control permits fading from phono to an auxiliary input for versatile effects. The antifeedback control helps suppress acoustical feedback when acoustics are poor or the microphones are too close to the loudspeakers. The scratch filter suppresses needle scratch when poor quality records are being played. The rumble filter suppresses low frequency rumble from the turntable. Separate bass and treble tone controls enable the user to separately boost or attenuate treble or bass tones for the most pleasing effect.

A variety of output impedances and constant voltages are available from the output terminal strip or 5 pin receptacle. The output taps will accommodate virtually all loud speaker and installation requirements.

A convenience outlet is available on the rear to accommodate a tuner or phonograph. The convenience outlet and amplifier are separately fused.

OPERATING INSTRUCTIONS

Figure #1 is a front panel photograph of the amplifier showing all of the operating controls. Fig. #2 is a rear view of the amplifier showing the input and output jacks

Each MICROPHONE GAIN control sets the level of the microphone signal.

The PHONO-AUX sets the phono or aux gain and is used to fade from the phono to the aux channel.

The MASTER GAIN controls overall amplifier volume.

The tone controls will not attenuate or boost the sound when left in their mid or flat position and the amplifier sound will be essentially the same as the original material.

When the BASS and TREBLE controls are rotated clockwise, the bass or treble response is boosted. When these controls are rotated counter-clockwise, bass or treble response is attenuated.

The SCRATCH FILTER when placed in the IN position attenuates needle scratch from poor quality records.

The RUMBLE FILTER attenuates turntable rumble when the switch is in the IN position.

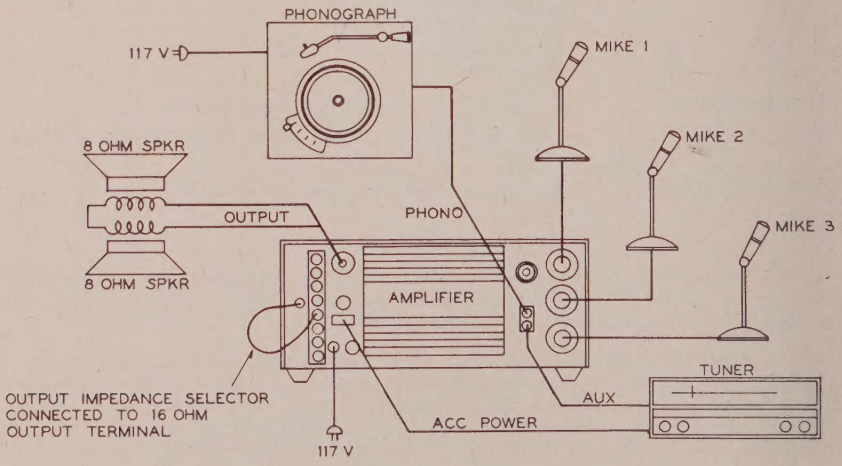


Fig. 3—Typical Inter-Connection of Accessories.

If objectionable acoustical feedback is present, the ANTI-FEEDBACK ON-OFF should be switched to ON, and the ANTI-FEEDBACK control on the front panel adjusted until feedback disappears.

A ball point pen can be used to write in the location of each microphone in the white area just below the MICROPHONE GAIN control.

A typical interconnection of the amplifier and an associated speaker system is shown in Figure #3.

During initial break in period, if the amplifier becomes inoperative, perform the corrective steps outlined in the information on the thermal cut-out near the end of this instruction manual.

USING THE ANTI-FEEDBACK CONTROL

The B & K Models 3000 and 6000 amplifiers incorporate a unique anti-feedback system. Greater sound levels can be obtained without objectionable acoustical feedback. Using the tuneable notch filter to "Tune Out" the unwanted feedback frequency, permits the amplifier gain to be increased for greater coverage and effectiveness.

The amplifier gain controls are adjusted for normal operation with the ANTI-FEEDBACK switch in the OUT position. If additional gain is now required, the Microphone gain is increased until feedback takes place. The ANTI-FEEDBACK IN-OUT switch is switched to the "IN" position. The ANTI-FEEDBACK control is slowly rotated until the feedback disappears. It might be necessary to slightly readjust the Microphone Gain controls for optimum results.

The best position of the anti-feedback control will vary depending upon the room acoustics. If the auditorium is empty and then becomes filled, this will result in a different feedback path and the microphone gain and anti-feedback controls might require a different setting. If the location of the microphones or speakers are changed, the feedback path will change and readjustment will be required.

Additional control over the feedback frequency can sometimes be obtained by using the bass and treble tone controls to help attenuate the feedback frequency.

CONNECTING MICROPHONES

A cannon type XLR-3 or equivalent audio connector is required for each microphone.

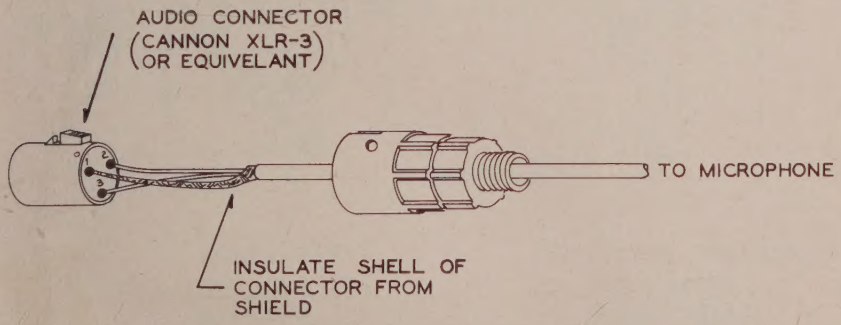


Fig. 4—Connector Wiring for Low Impedance Microphone.

Figure #4 shows how to wire the microphone cable to the connector when a low impedance microphone is used. The shielded balanced lines connect to terminals #2 and #3 of the audio connector. The shield connects to terminal #1. Be sure that the shield does not touch the metal shell of the connector by taping the shield lead going to pin #1.

Figure #5 shows how a high impedance microphone is connected to the audio connector. The shielded lead is connected to pin #2 of the connector. The shield should be insulated with tape so that it does not touch the metal shell of the connector. The shield should be connected to pin #1 of the audio connector. Pin #3 is not used with a high impedance microphone.

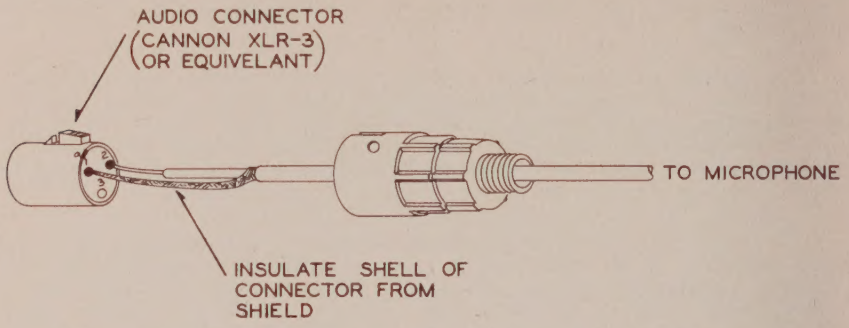
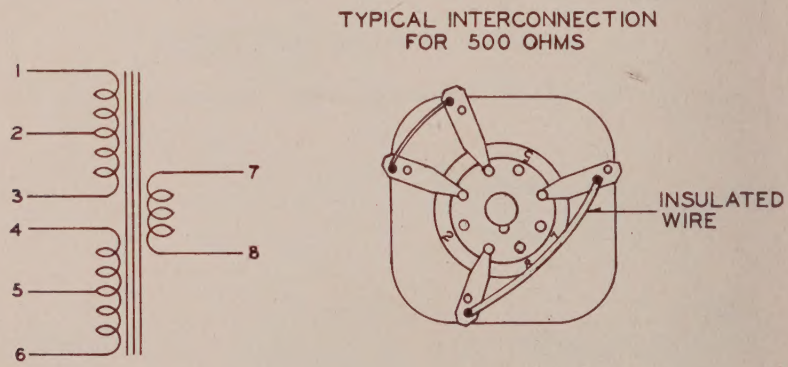


Fig. 5—Connector Wiring for High Impedance Microphone.

When a low impedance microphone is used, a microphone input transformer must be used to match the microphone to the input impedance of the amplifier. Figure #6 is a schematic and a typical interconnection for a 500 ohm low imped-



MICROPHONE IMPEDANCE	STRAP LEADS
30/50 OHMS	1-5 AND 2-6
125/150 OHMS	1-4 AND 3-6
250/300 OHMS	2-4 AND 3-5
500/600 OHMS	1-6 AND 3-4

Fig. 6—Inter-connection of Low Impedance Microphone Input Transformer.

ance microphone. The dummy plug is removed from the top of the chassis (see Figure #7 showing top of chassis) corresponding to the low impedance microphone input. For example: Suppose a low impedance microphone is desired for Channel

#1, the dummy plug is removed for Channel #1 and a microphone input transformer is inserted in this plug. If the microphone is 500 ohms the transformer is wired externally with the jumpers connected per the table which is shown in Figure #6 before the transformer is inserted.

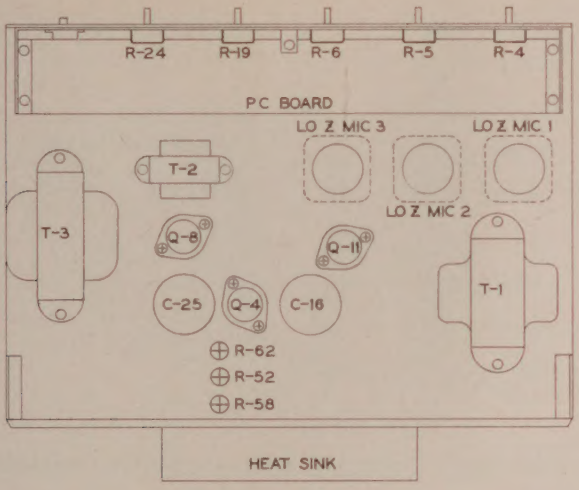


Fig. 7—Top of Chassis.

CONNECTING SPEAKERS

A single speaker can be connected to the output jack of the amplifier by connection between the common and appropriate impedance tap on the output terminal strip.

More than one speaker can be connected to the amplifier by series or parallel connections of speakers to effect an impedance match to the amplifier. Figure #8

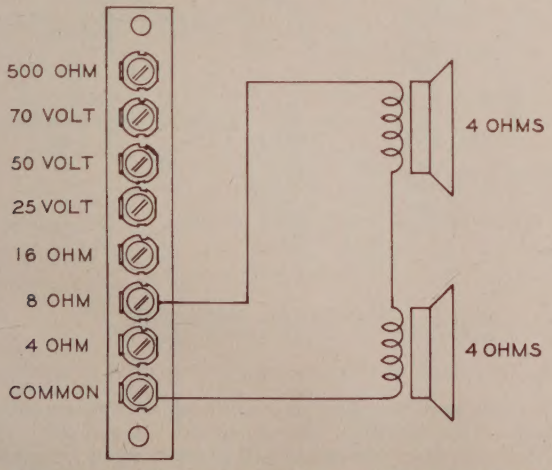


Fig. 8—Two 4 Ohm Speakers Connected in Series for a Sum of 8 Ohms.

shows two 4 ohm speakers connected in series. The impedance of series connected speakers is additive so that the total impedance is 8 ohms. The speakers are connected across the 8 ohm tap. If the amplifier is rated at 30 watts, each of the two speakers should have a rating of 15 watts.

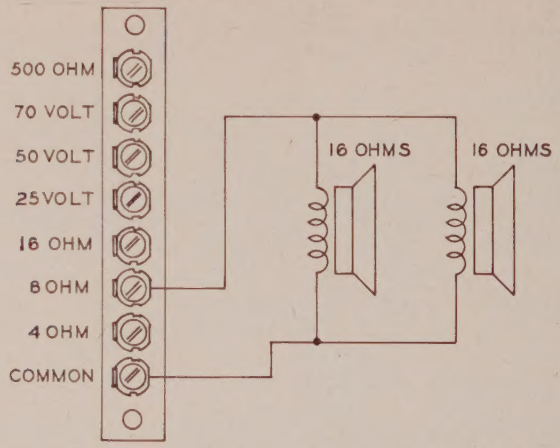
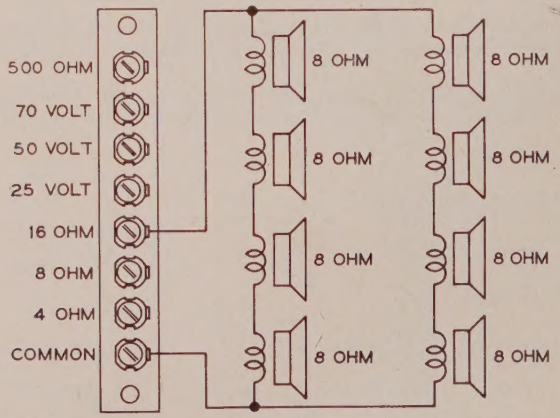


Fig. 9—Two 16 Ohm Speakers Connected in Parallel for an Equivalent Impedance of 8 Ohms.

Figure #9 shows two 16 ohm speakers connected in parallel. If two equal impedance speakers are connected in parallel, the equivalent impedance is ½ the impedance of a single speaker. The speakers are connected to the 8 ohm tap.



SERIES AND PARALLEL COMBINATION OF SPEAKERS TO MATCH AMPLIFIER

Fig. 10—Example of Series and Parallel Combination of Speakers.

It is possible to connect speakers in a series parallel arrangement to effect an impedance match to the amplifier. As an example, see Figure #10. Here, two strings of four ohm speakers are connected in series for a total impedance of 16 ohms. Both strings are connected in parallel for an equivalent impedance of 8 ohms.

All of the speakers shown in the above connections provide an equal amount of audio power. If the amplifier is rated at 30 watt and 6 speakers are used, each speaker should be rated at 5 watts or greater. If 10 speakers are used, each speaker should be rated at 3 watts or greater.

If the speakers are to be located greater than 200 feet from the amplifier, or different acoustical levels are required from each speaker, constant voltage line transformers should be used. The constant voltages available from the amplifier are 25, 50 and 70 volts.

The constant voltage line is similar to a power line where various wattage loads are connected in parallel across a 117 V A.C. power line. Each bulb might have the same or different power rating. Regardless of the power rating of the bulb, the 117 volt line voltage remains constant. Figure #11 is a typical example of this type of connection.

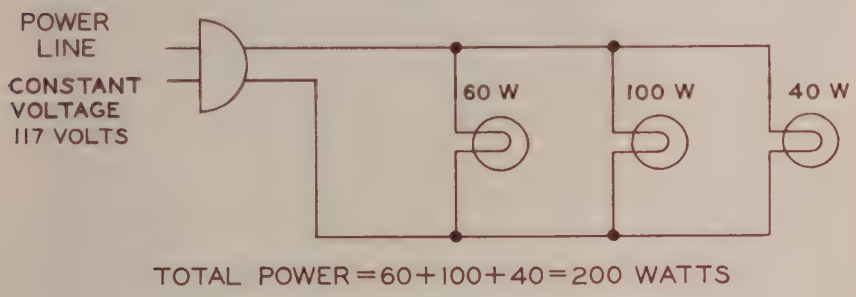


Fig. 11—Light Bulb Analogy to Constant Voltage Output of Amplifier.

The same principle can be used on a constant voltage line of an audio amplifier. However, the total power drawn from the constant voltage line should not exceed the power rating of the amplifier. The sum total power of all of the speakers should not exceed the amplifier rating.

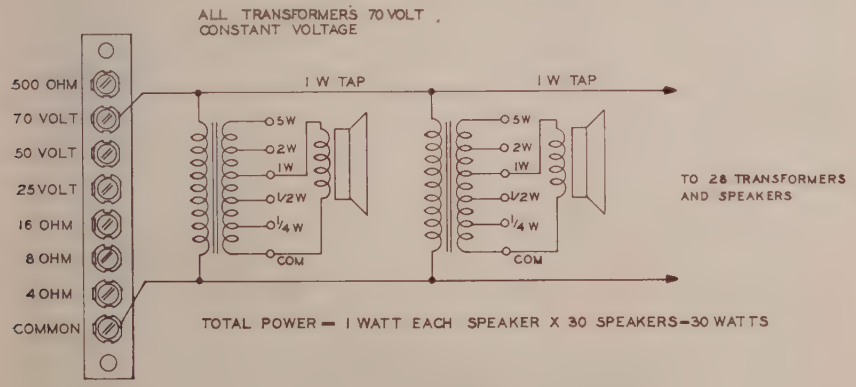


Fig. 12—Example of Equal Audio Power Distribution.

Figure #12 shows 30 speakers and constant voltage transformers connected to the 70 V constant voltage output of the amplifier. Each of the 30 speakers will

draw 1 watt for equal power distribution to each speaker. Each speaker should be rated for 1 watt or more. It is important not to exceed the power rating of the amplifier.

If requirements necessitate unequal audio power at different locations, the individual speaker transformers can accommodate this variation. See Figure #13 for five speakers connected in this manner.

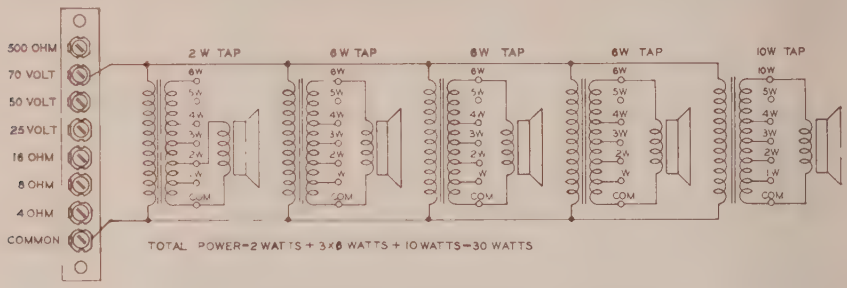


Fig. 13—Example of Unequal Audio Power Distribution.

It is also possible to series or parallel speakers to a single line transformer. Figure #14 shows two series 8 ohm speakers connected to the 16 ohm 20 watt transformer tap. Here each speaker will deliver 10 watts and should be so rated. The 16 ohm speaker will also provide 10 watts of audio power. The total power is 30 watts or the amplifier rating.

Constant voltage line transformers come with instructions for connecting all values of speaker impedances and power levels required in a normal installation.

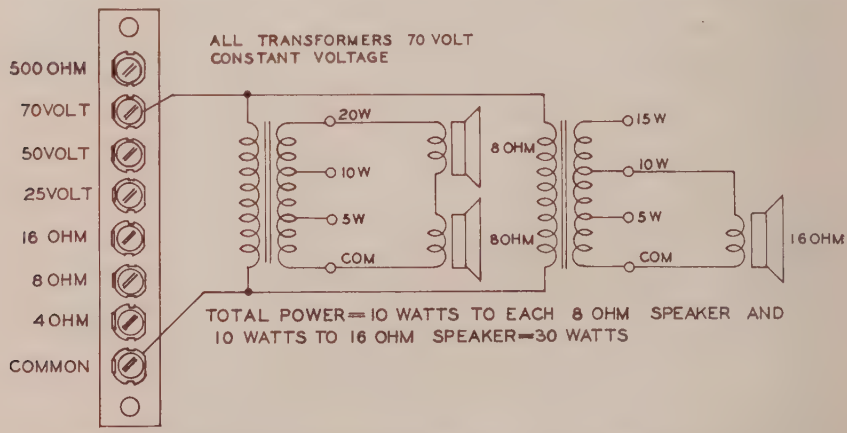


Fig. 14—Example of Series Connected Speakers to Constant Voltage Transformer.

The previous constant voltage examples are based upon using a 30 watt amplifier and the 70 volt constant output voltage tap from the amplifier. Other amplifier power ratings and constant voltages can be utilized but the principles of determining the individual speaker ratings and proper connection is the same. The lower constant voltages are generally used when open unshielded wiring to the line transformer is permissible.

The 500 ohms constant impedance output of the amplifier is used with transformers also. The equivalent impedance of line transformers must match the 500 ohm output impedance of the amplifier.

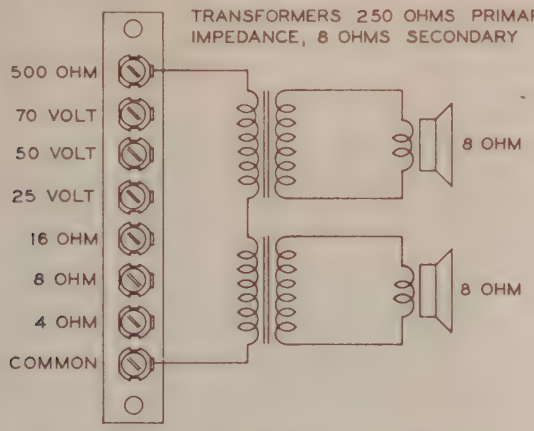


Fig. 15—Example of Series Connection of Transformer Primaries.

Figure #15 shows how two 250 ohm primary to 8 ohm secondary transformers are connected to the 500 ohm tap of the amplifier. The secondary of each transformer is rated for 8 ohms to match an 8 ohm speaker. The primary of each

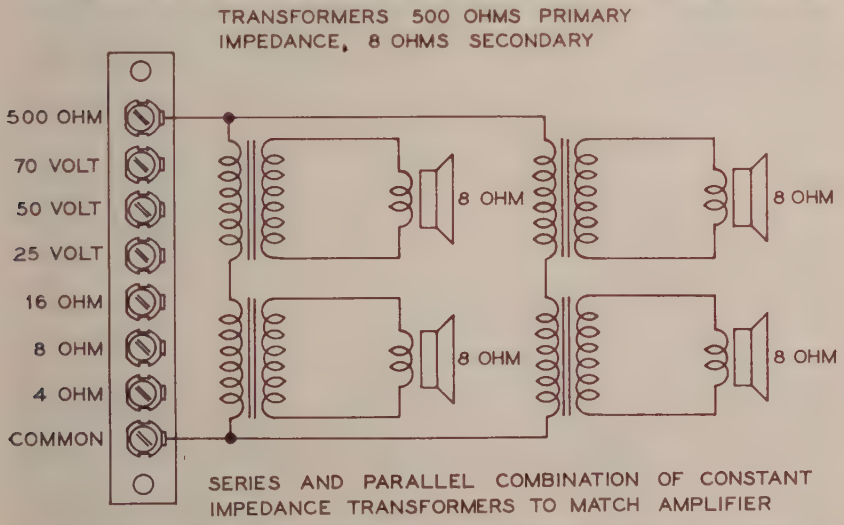


Fig. 16—Example of Series and Parallel Connection of Constant Impedance Transformers.

transformer is 250 ohms. Both transformer primaries are connected in series for an additive total of 500 ohms.

Figure #16 shows a series and parallel arrangement of 500 ohm primary trans-

formers for an equivalent impedance of 500 ohm to match the amplifier. In these examples, the amplifier rating is divided equally among the speakers. In Figure #15 each speaker should have a rating of at least 15 watts. In Figure #16 each speaker should have a rating of at least 7½ watts.

It is possible to series or parallel speakers or a combination of both to a single transformer secondary. The total power delivered to the secondary is divided equally among the speakers if equal speaker impedances are used.

USING THE SPEAKER JACK

For added convenience, a speaker jack is provided on the rear panel of the amplifier. See Figure #2. A 5 prong plug is required for connection to this jack (Amphenol 86 CPS or equivalent). Pin #4 is the common lead and Pin #2 is the lead that goes to the autoformer tap. The desired tap is selected by connecting the jumper wire with the spade lug to the desired impedance or voltage.

ACCESSORIES

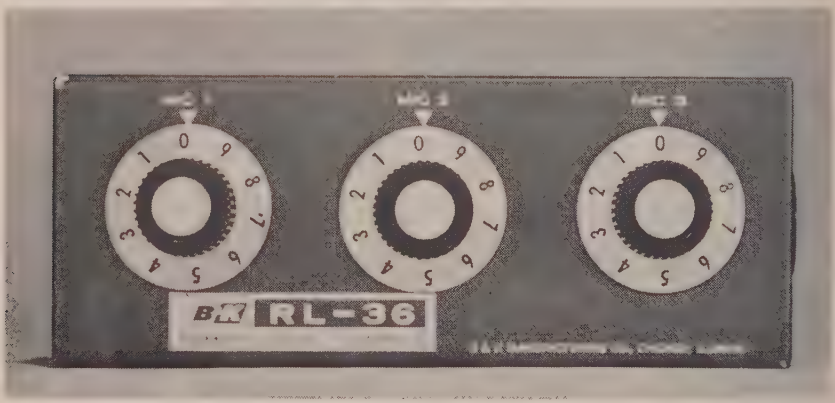


Fig. 17—RL-36 Remote Level Control.

Figure #17 is a photograph of the Model RL-36 Remote Level Control. The amplifier can be installed at a location convenient to the microphone and speaker lines. The gain of each microphone can be controlled at a more desirable location. For example, the microphone gain could be controlled from the rear of the auditorium to make sure the audio level is satisfactory to those in the audience farthest away from the speakers.

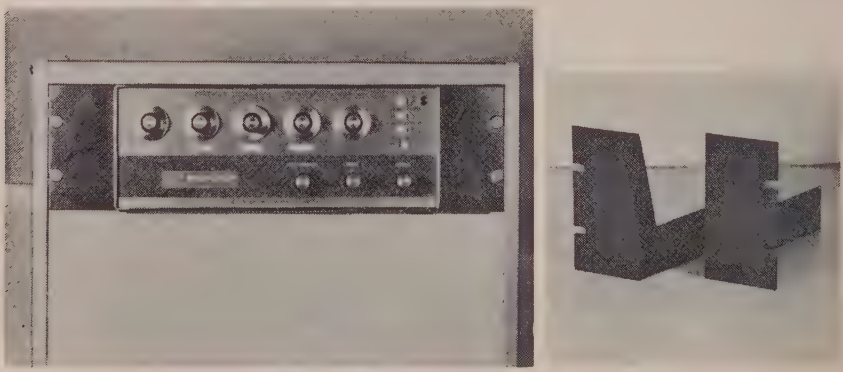


Fig. 18—Amplifier Mounted Relay Rack Adapter Model RR-29.

Figure #18 is the amplifier mounted in a standard relay rack using the Model RR-29, Relay Rack Mounting Kit.

Figure #19 shows the amplifier mounted on a wall surface using the Model WM 28 Wall Mounting Kit. It is possible to mount the amplifier at various convenient angles for ease in adjusting the amplifier controls.

Fig. 19—Amplifier Mounted on Wall Surface, Using Model WM-28 Wall Mounting Kit.

Figure #20 is a photograph of the microphone input transformer (Part #AIT 37) which is used with low impedance microphones.

Fig. 20—Low Impedance Microphone Input Transformer.

Figure #21 shows the phono turntable Model PH-27 atop the amplifier.

This is a four speed turntable complete with dual tip turnover cartridge. The turntable will play all 16, 33, 45 and 78 speed records. The turntable can be mounted atop the amplifier or can be operated along side the amplifier.

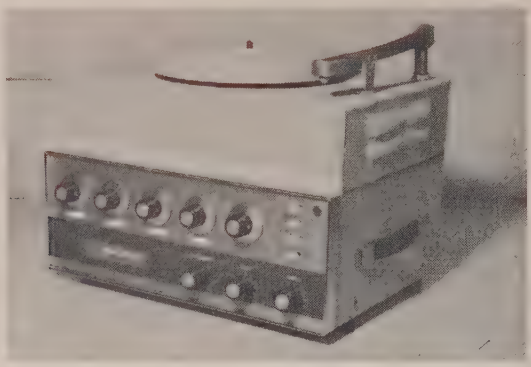


Fig. 21—Turntable Atop Amplifier.

THEORY OF OPERATION

Q-1 is a low noise transistor used as a microphone preamplifier. The input impedance is increased as a result of positive feedback thru C-5 and R-9 from emitter to base. The gain controls do not load the input circuit since their return circuits are also connected to the positive feedback thru C-3.

The output of Q-1 is connected to a bridged "T" variable frequency filter. This filter attenuates the unwanted acoustic feedback frequency. This filter is switched in or out of the circuit by switch SW-1. The output of Q-1 is connected to mixer-amplifier Q-2 directly or thru the antifeedback filter. Q-1 connects directly to the base of Q-2 thru C-4 when the antifeedback on-off switch is in the off position. When the antifeedback is in the on position the signal passes thru bridged "T" filter R-13, R-14, C-6 and C-7.

The phono-aux control selects and controls the gain of the phono and auxiliary channels. The signal from this gain control is fed to the base of Q-2 thru R-20 and C-9. The output of Q-2 goes to a shunt divider master gain control R-24. The master gain control drives transistor Q-3 which in turn drives the feedback amplifier tone control circuit.

Q-5 is a feedback type tone control circuit. The tone controls are in the feedback circuit. The response of amplifier Q-5 is controlled by the position of the tone controls.

The signal is next amplified by Q-6. A negative feedback voltage is derived from the amplifier output and is connected to the emitter of Q-6. Q-6 acts as a grounded emitter stage for signal. The signal at the base of Q-6 is degenerated by means of this emitter feedback. There is approximately 22 D.B. of negative degenerative feedback in the amplifier feedback loop. The 50 P.F. capacitor (C-22) connected from collector to base prevents high frequency oscillations by degenerating the feedback amplifier close to its cut-off frequency where high frequency phase shift becomes excessive.

The collector of Q-6 is connected to the base of Q-7. The emitter of Q-7 is connected to the base of Q-8. The voltage on the collector of Q-6 is essentially the same as the voltage on the emitter of Q-8.

Q-8 is an emitter follower driver. The 3 windings of T-2 are tri-filar wound giving excellent coupling and transient response. The output stage is a class "B" amplifier. Phasing of the secondary is such that each output device conducts on alternate ½ cycles. The device Q-9 conducts and capacitor C-25 charges towards the supply voltage. During the remaining ½ cycle device Q-10 conducts and capacitor C-25 is discharged. The charging and discharging current of coupling capacitor C-25 is thru the 8 ohm tap of the auto transformer which constitutes the amplifier load impedance.

The maximum peak-to-peak voltage swing of the amplifier is the supply voltage. Resistor R-57 and capacitor C-28 compensates for the rising inductive characteristics of most speakers at high frequencies. The output autoformer provides all common impedance and voltage taps.

The return of the output circuit is thru sampling resistor R-61 which controls the voltage drop across Q-11. When the amplifier is terminated in its proper load impedance, and delivering full power, the voltage drop across Q-11 is high. In case of an overload, the voltage drop across Q-11 decreases resulting in a lowering of the base to ground voltage of electronic filter Q-4. This decreasing voltage automatically limits the signal drive to the driver and preamplifier thus limiting the output transistor current to a safe value.

THERMAL CUT-OUT

The thermal cut-out is located on the inside of the heat sink between the two transistors. The thermal cut-out (M-1 on the schematic) prevents overloading the amplifier when an improper load is connected or a short circuit is sustained in the load. During a short circuit or improper load, the temperature of the output transistors Q-9 and Q-10 increases. This increases the temperature of the heat sink causing the thermal cut-out to operate. The amplifier then becomes inoperative until the heat sink cools down. It takes about 5 minutes for the thermostat to automatically reset itself.

If the thermostatic overload shuts the amplifier off, turn the power switch to off and correct the trouble in the speaker system before turning on the amplifier again. If a short or incorrect load is sustained, the amplifier will continue to automatically turn itself on and off.

FUSES

Separate fuses are provided for the amplifier and the auxiliary outlet. The amplifier fuse provides protection in case of a power supply short or failure of the output transistors. The auxiliary fuse provides protection in case of a short circuit in auxiliary equipment.

CHANGING DRIVER AND OUTPUT TRANSISTORS

In case it becomes necessary to ever change the driver transistor Q-8 or the power output transistors Q-9 and Q-10, be sure to replace the mica washer between the transistor mounting surface and the chassis. The mica washer should have a liberal amount of silicone grease (Dow Corning DC-5 compound) smeared on both

sides. For transistors Q-9 and Q-10, the insulating nylon shoulder washers should be in place to prevent the mounting screws from shorting to the heat sink.

CROSSOVER DISTORTION

If the output transistors have been replaced, it is necessary to readjust controls R-52 and R-58 for low level crossover distortion. It is also necessary to readjust R-62 for proper overload clipping. (See Fig. #7 for location of controls.) Figure #22 shows the equipment required to make these adjustments. With a 1 volt signal from the audio oscillator at 400 CPS, adjust the master gain and auxiliary gain for 1 watt output or approximately 3 V RMS measured on the voltmeter.

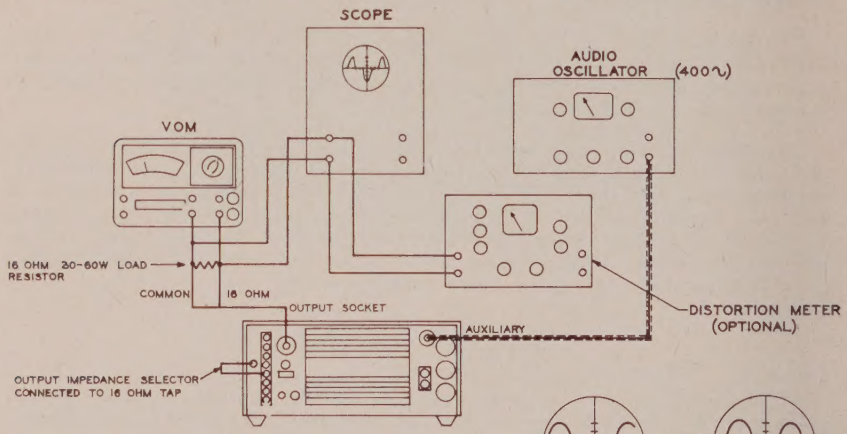


Fig. 22—Equipment Required for Crossover Distortion and Overload Adjustments.

SINE WAVE WITH CROSSOVER

Fig. 23.

PURE SINE WAVE

Fig. 24.

Observe the waveform on the oscilloscope and adjust R-52 and R-58 for a pure sine wave. If a distortion meter is connected, adjust the controls R-52 and R-58 for minimum distortion. Figure 23 is an example of sine wave with crossover distortion. Figure 24 is what the waveform should look like after adjustment.

After completing the crossover distortion adjustment, increase power output of the amplifier by adjusting the phono-aux and master gain controls to maximum. This will result in a power output greater than 30 watts for the Model 3000. This would be a voltage greater than 15.5 V RMS. Now adjust the overload control R-62 until the voltmeter reads 15.5 volts. For the Model 6000 the voltage would be 21 volts. If no equipment is available, the controls R-52 and R-58 can be adjusted by ear for minimum distortion at a low listening level. This completes all of the internal adjustments and the amplifier is ready for operation.

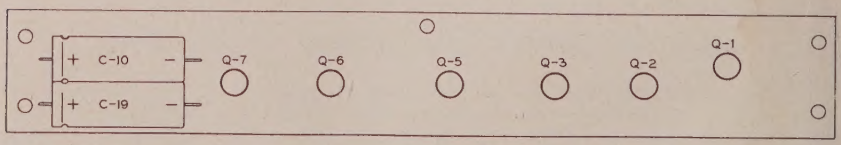


Fig. 25—Location of Transistors on Printed Circuit Board.

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the maintenance section of the instruction manual for adjustments that may be applicable.
2. Check common electronic parts such as tubes and batteries. Always check instruction manual for applicable adjustments after such replacement.
3. Defective parts removed from units which are within the warranty period should be sent to the factory prepaid with model and serial number of instrument from which removed and date of instrument purchase. These parts will be exchanged at no charge.
4. If the above mentioned procedures do not correct the difficulty, pack the instrument securely (preferably double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B&K authorized service agency.

Contact your local B&K Distributor for the name and location of your nearest service agency, or write to

Service Department

B&K MANUFACTURING COMPANY

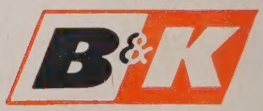
DIVISION OF DYNASCAN CORPORATION

1801 W. Belle Plaine

Chicago 13, Ill.

WARRANTY

"B & K warrants that each instrument manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of ninety days after its purchase new from an authorized B & K distributor. Our obligation under this warranty is limited to repairing, or replacing any instrument or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory or our authorized service contractor, transportation prepaid, and we shall not otherwise be liable for any damages, consequential or otherwise. *The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether express or implied.* Such warranty shall not apply to any instrument or component (i) repaired or altered by anyone other than B & K or its authorized service contractor (except normal tube replacement) without B & K's prior written approval; (ii) tampered with or altered in any way or subjected to misuse, negligence or accident; (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B & K's instructions. B & K reserves the right to discontinue any model at any time or change specifications or design without notice and without incurring any obligation. *The warranty shall be void and there shall be no warranty of any instrument or component if a B & K warranty registration card is not properly completed and postmarked to the B & K factory within five days after the purchase of the instrument new from an authorized B & K distributor."*



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1801 W. BELLE PLAINE AVE. • CHICAGO, 13

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